

THE JAPANESE AMPHIPOD GENUS *EONIPHARGUS*, REDISCOVERED IN A SOUTH KOREAN CAVE

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Abstract.—*Eoniphargus*, a monotypic genus, known only from the Tokyo area, Japan, has been rediscovered in cave waters of South Korea. The Korean animals are a new species, *E. glandulatus*, which bridges to a certain extent the gap between *Eoniphargus* and the Indian genus *Indoniphargus*. Their morphology indicates that these genera are more closely related to the Gammaridae than to the Crangonyctidae.

Among a number of stygobiont amphipods collected by the junior author in cave waters of South Korea, a representative of a new species was discovered belonging to a small group of two monotypic genera, *Eoniphargus* Uéno, 1955 (*Eoniphargus* was originally described as a subgenus of *Neoniphargus*, but was elevated to generic rank by Straškraba 1964), and *Indoniphargus* Straškraba, 1967. The former is known from a single locality near Tokyo (Japan), whereas the latter is known from the states of West Bengal and Orissa (India). The Korean taxon bridges to a certain extent the gap between *Eoniphargus* and *Indoniphargus*: of the ten discriminating characters, three agree better with *Indoniphargus*, whereas seven correspond with *Eoniphargus* (Table 1). The resemblance to *Eoniphargus* bears amongst others on the shape of the gnathopods 1 and 2, and the armature of the inner and outer lobes of maxilla 1, both considered of prime importance in amphipod taxonomy. The resemblance to *Indoniphargus* bears on "weak" characters (urosome spination, number of segments in the accessory flagellum, absence of calceoli), known to be variable, sometimes even at infraspecific level. Therefore, the Korean form has been attributed to *Eoniphargus* rather than to *Indoniphargus*.

Eoniphargus and *Indoniphargus* have often been thought related to the crangonyctids or crangonyctoids (e.g., Bousfield

1977:table VI, Bousfield 1982:262, Straškraba 1964:table I, Straškraba 1967). Barnard & Barnard (1983) classify *Eoniphargus* near the gammarids, but *Indoniphargus* near the melitids. Clearly enough, and contrary to what the generic names suggest, these genera are not closely related to the Niphargidae. In our opinion, several points in their morphology prohibit inclusion in the crangonyctids s.l. (= superfamily Crangonyctoidea Bousfield), e.g., the asymmetrical palps of left and right maxillae, the occurrence of spines on the urosome, the 'eulimnogammarid' shape of the gnathopods of *Eoniphargus*, the absence of sternal gills, the absence of a coxal gill on pereopod 7, the absence of a double row of distally-notched spine teeth on the palm of the two gnathopods, the rather elongate third uropod, the occasional presence of calceoli described as shoe-shaped by Uéno (1955:fig. 1) on antenna 2 of the male. None of these characters alone is sufficient proof of a non-crangonyctid relationship, but in combination they probably show that *Eoniphargus* forms a subgroup of the gammarids (or gammaroids, if one believes in superfamilies in this group).

Eoniphargus glandulatus, new species

Material.—1 ♀ (holotype), 1 ♂ (allotype), 4 paratypes. South Korea, Ondal-gul (gul = cave), Prov. Choongbuk, Danyang-gun,

Table 1.—Comparison of some salient characters of the new Korean taxon (K), *Indoniphargus indicus* (I), and *Eoniphargus kojimai* (E).

	K	I	E
Armature urosomites	spines + setules	spines + setules	setules
A1, acc. flag.	1-segmented	2-segmented	4-segmented
A2 δ , calceoli	absent	absent	present
Distal segm. Md. palp	long	short	long
Mx.1, inner lobe	broad, with 11 setae	finger-shaped, with 2 setae	broad, with 8 setae
Mx.1, outer lobe	10 spines	8 spines	10 spines
Mx.2, inner lobe, oblique row of setae	present	absent	present
Gn.1 & 2, carpus	non-lobate	lobate	non-lobate
Gn.1 & 2, propodus	elongate	mittenform	elongate
Peduncle uropod 1, ventral spine(s)	absent	present	absent

Youngchoon-myeon, Ha-ri (128°30'E, 37°04'N); pools of 10–20 cm deep in limestone cave, 50–120 m from entrance (dim light to complete darkness); water temperature 12.5°C; 11 Oct 1986; leg. Y. W. Jo and H. J. Lee, ZMA Amph. 108.633.

Description.—Body length of ♀ up to 6 mm, ♂ 4.5 mm. Blind, colourless in alcohol. Body shape as in Fig. 1a. Lateral lobe of head rounded (Fig. 1b); antennal sinus very shallow. Coxal plates 1 to 4 deep, 5 to 7 shallow. Dorsum of metasome with a few setules. Urosomite 1 with variable armature: 1 lateral spine + 1 dorsal setule or 1+1 setules; urosomite 2 with 2 lateral spines, sometimes 1 additional lateral setule, and 1 dorsal setule; urosomite 3 unarmed (Fig. 1h).

Antenna 1 (Fig. 1c): Peduncle segment 1 longest; segment 2 slightly longer than 3. Flagellum with up to 25 segments; short aesthetascs on segments 5 to 22. Accessory flagellum slightly longer than first flagellum segment, 1-segmented.

Antenna 2 (Fig. 1d) with very long, tapering gland cone. Peduncle segments 4 and 5 thin and slender. Flagellum 7-segmented. Calceoli absent (δ , ♀).

Upper lip (Fig. 3c) rounded. Lower lip (Fig. 3d) without inner lobes.

Mandible (Fig. 2a): Molar setae present both on right and left appendage; left lacinia mobilis 5-dentate; right lacinia bifid; 3 spines + 3 plumose setae between molar and incisor of left mandible, 2+2 right. Palp (Fig. 2b) strong; segment 1 unarmed; segment 2 with row of about 10 ventrodial setae; segment 3 with regular row of c. 15 D-setae, 1 B-setule, 4 E-setae, but without A- or C-setae.

Maxilla 1 (Fig. 2c, d): Palps asymmetrical (left more slender, with 5 slender spines and 1 seta; right more robust, with 6 robust spines and 1 seta). Outer lobe with 10 distal spines, each spine with 4 to 10 medial denticles. Inner lobe rounded-triangular, with 11 plumose setae on medial margin.

Maxilla 2 (Fig. 2e) with oblique row of 14 strong setae on inner lobe.

Maxilliped (Fig. 2f): Inner lobe with 3 short, robust distal spines. Outer lobe with 5 mediobasal spines; medial margin setose.

Gnathopods 1 and 2 with very slight sexual dimorphism (propodus in ♂ slightly larger in size than in ♀; palmar margin in ♂ with more setules than in ♀; largest palmar angle spine of Gn.2 longer in ♂ than in ♀).

Gnathopod 1 (Fig. 3a): Basis with 3 anterior and 5 posterior setae. Carpus unlobed. Propodus of similar shape in both

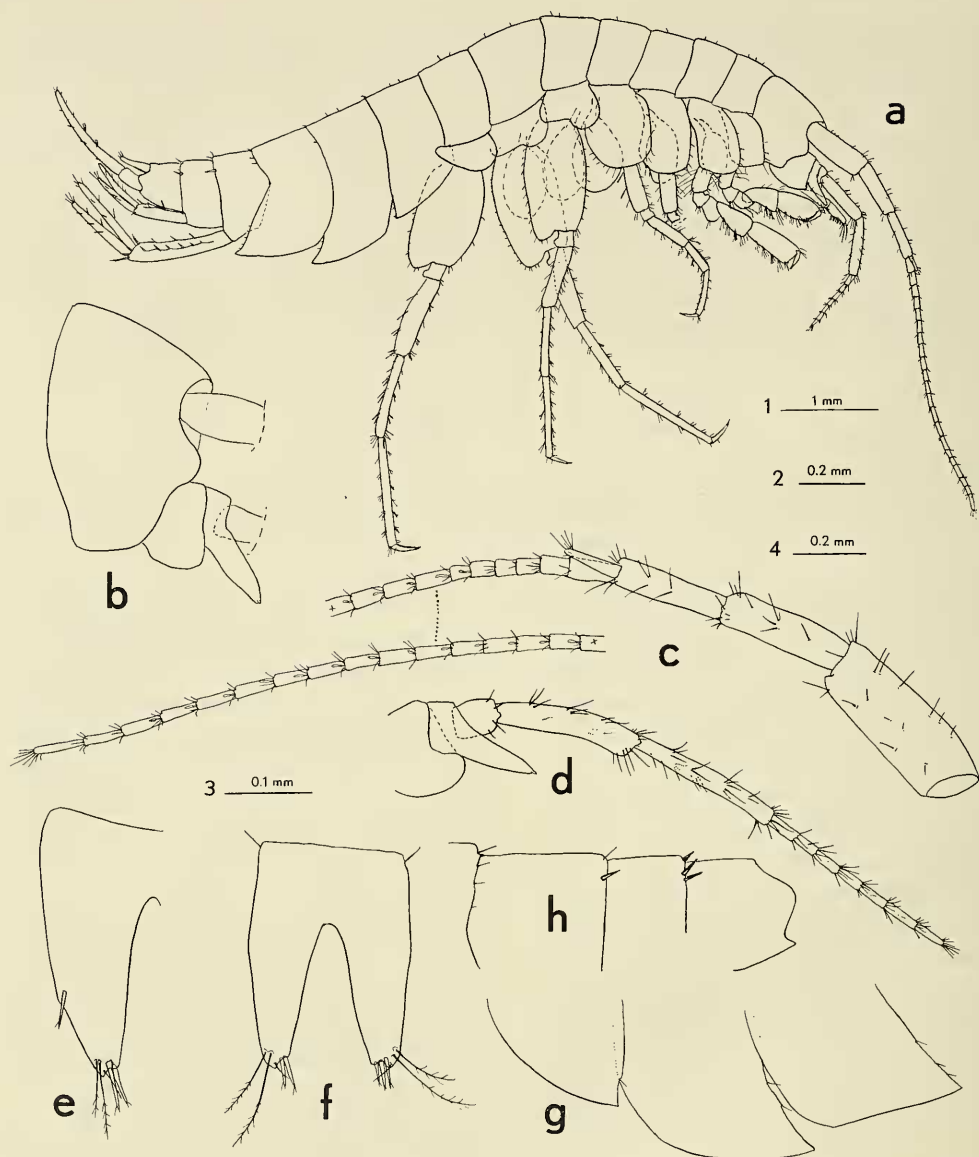


Fig. 1. *Eoniphargus glandulatus*: a, female, from the right, pleopods omitted (scale 1); b, head, ♀ (2); c, antenna 1, ♀ (2); d, antenna 2, ♀ (2); e, telson, left half, ♀ (3); f, telson, ♂ (3); g, epimeral plates, ♂ (2); h, contour of urosome, ♂ (4).

sexes, almost rectangular; 4 palmar angle spines (2 short, 1 medium, 1 very long); palmar margin with setules only (c. 6 in ♀, cf. Fig. 4a; c. 15 in ♂, Fig. 4b); claw slender; dactylus with 2 inner, 1 outer, and 3 distal setae; unguis shorter than dactylus.

Gnathopod 2 (Fig. 3b) slightly longer than Gn.1, but propodus "feebler" in appearance than that of Gn.1. Basis with 2 anterior and 7-9 posterior setae. Carpus more elongate than that of Gn.1. Propodus very narrow and slender in both sexes. Palmar angle with

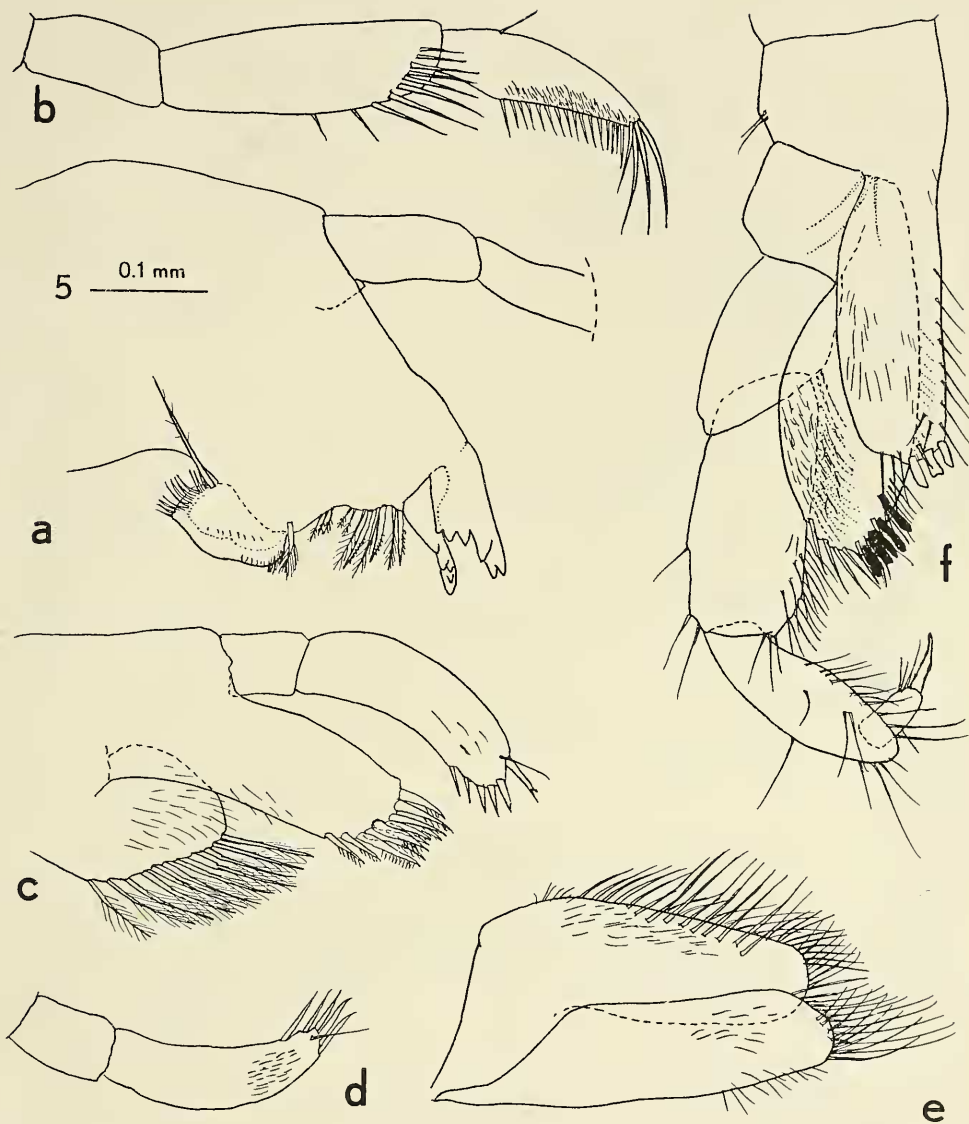


Fig. 2. *Eoniphargus glandulatus* ♀: a, left mandible; b, right mandibular palp; c, right maxilla 1; d, palp of left maxilla 1; e, maxilla 2; f, maxilliped. All scale 5.

4 spines (1 very long); palmar margin with setules only (c. 10 in ♀, Fig. 4c; c. 14 in ♂, Fig. 4d). Armature of claw as in Gn.1.

Pereiopod 3 (Fig. 5a) with long and narrow coxal plate. Distal segment poorly setose/spinose. Claw thin and slender. Coxal plate 4 (Fig. 5b) with shallow posterior

emargination; remaining segments of P4 as in P3.

Pereiopods 5 and 6 (Fig. 5c, e) broken in all specimens examined (reconstructed from the fragments in Fig. 1a). P5 shorter than P6, P7 longer than P6. Basis of P5 to P7 with strong posteroventral lobe. Dactylus

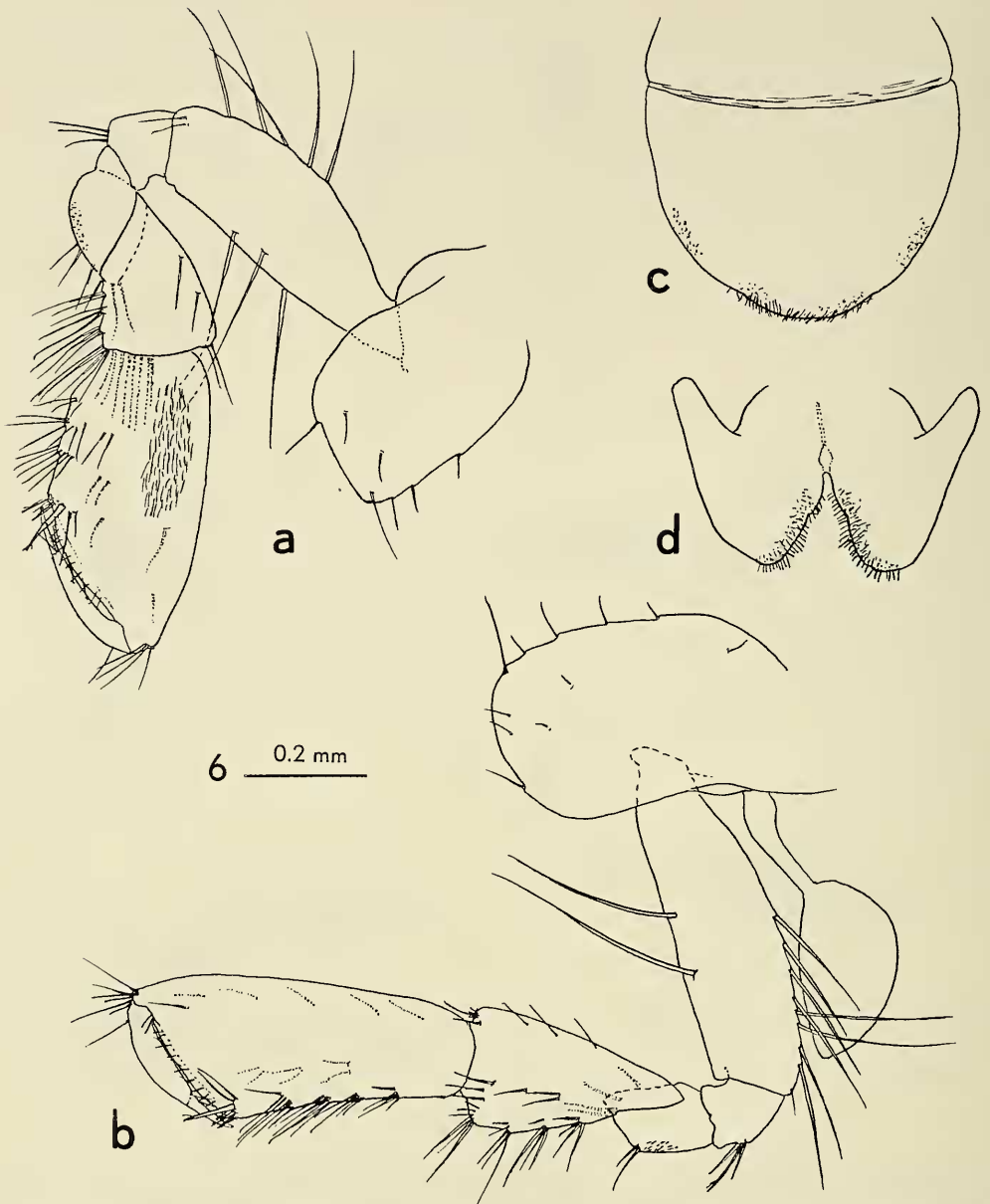


Fig. 3. *Eoniphargus glandulatus*: a, gnathopod 1, ♂ (scale 6); b, gnathopod 2, ♂ (6); c, upper lip, ♀ (5); d, lower lip, ♀ (6).

thin and slender, unguis small (Figs. 5c, 6d). Basis practically without sexual dimorphism (Fig. 5d).

Coxal gills large, ovate, with long basal stalk, present on Gn.2 and P3 through P6.

No sternal gills. Oostegites linear, non-setiferous (diapause stage), but with scars indicating insertion of c. 8 setae on margins of distal part (Fig. 5a); present on Gn.2 and P3 through P5.

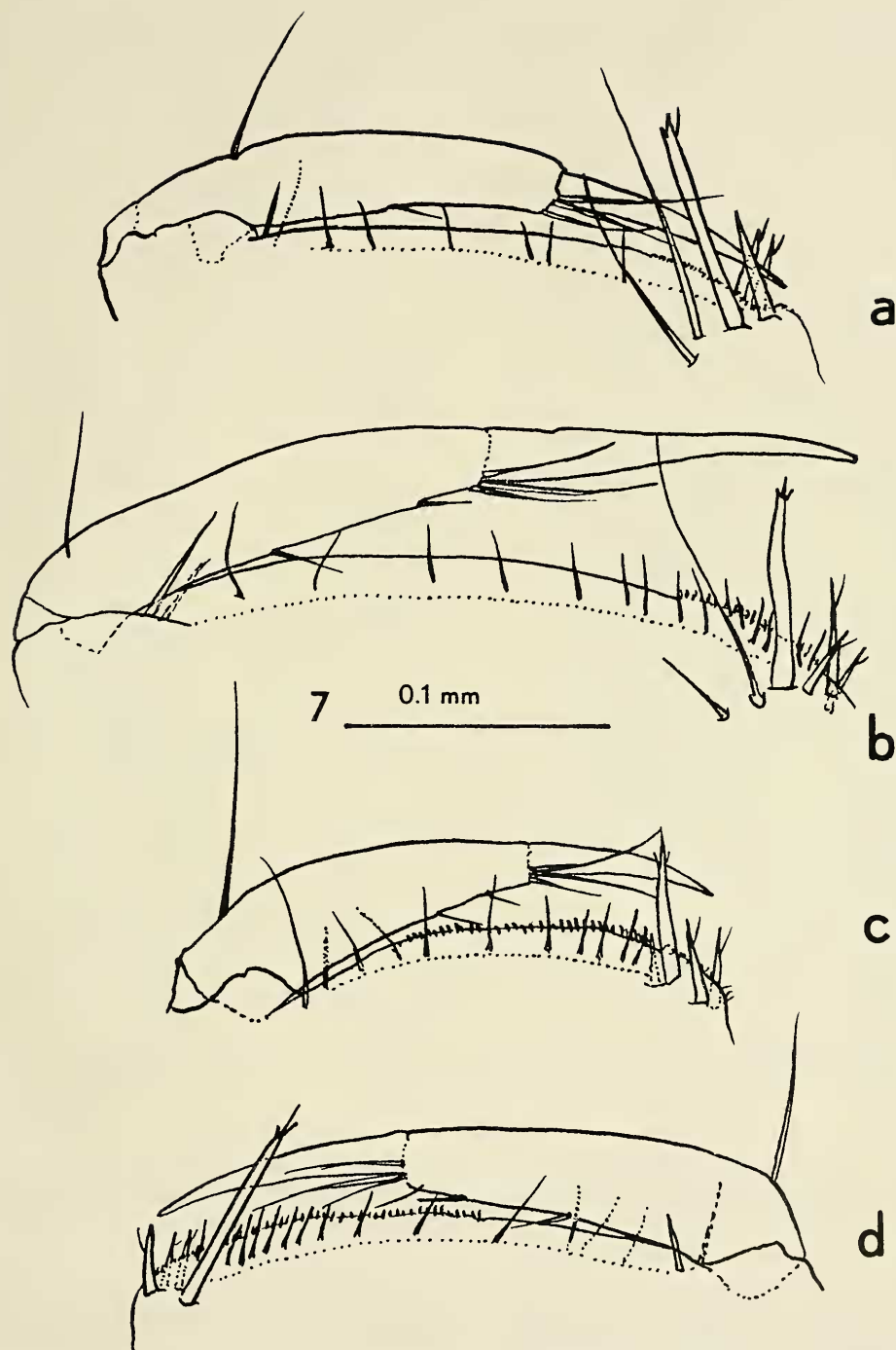


Fig. 4. *Eoniphargus glandulatus*: a, palma of gnathopod 1, ♀; b, palma of gnathopod 1, ♂; c, palma of gnathopod 2, ♀; d, palma of gnathopod 2, ♂. All scale 7.

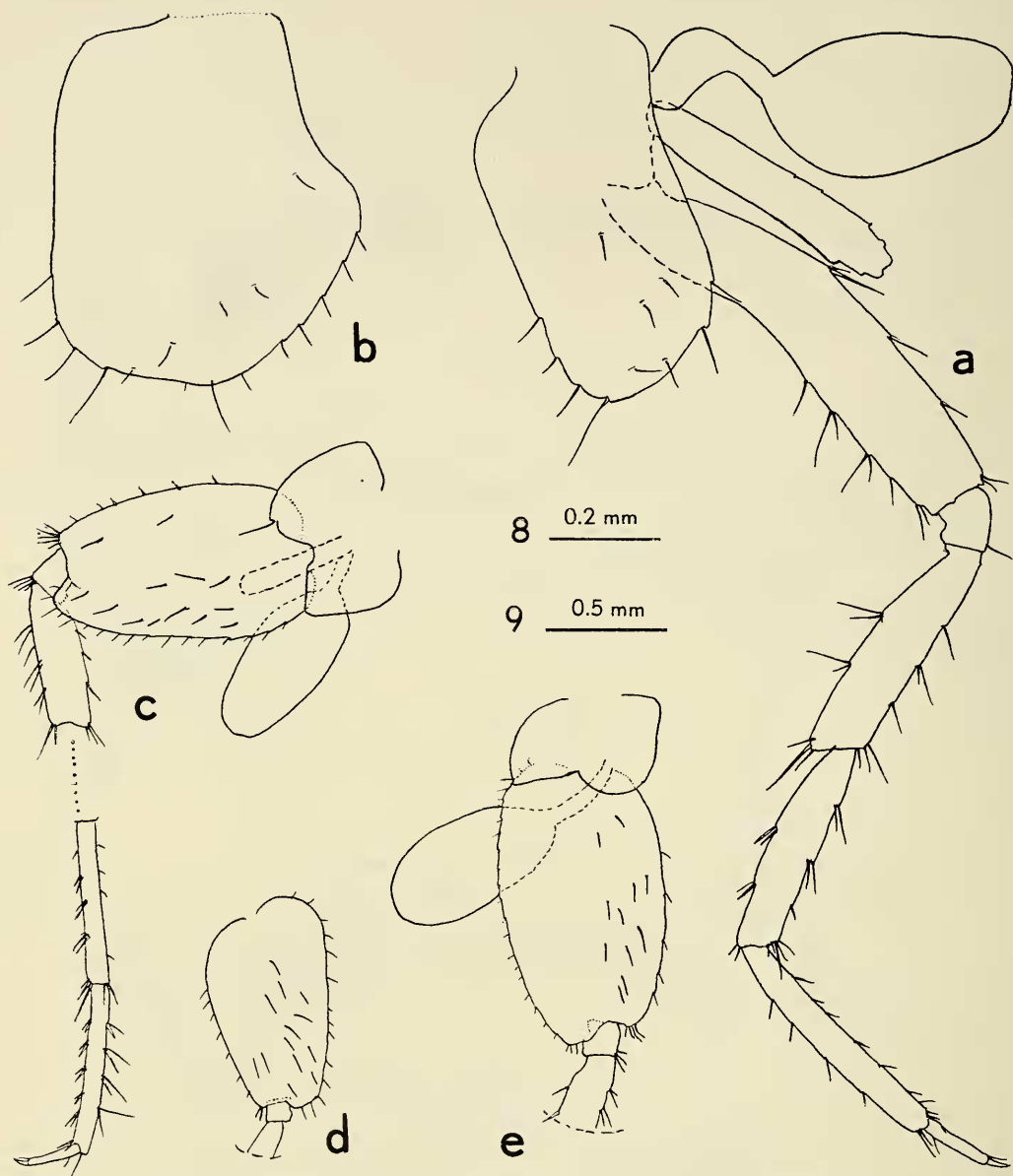


Fig. 5. *Eoniphargus glandulatus*: a, pereiopod 3, ♀ (scale 8); b, coxal plate of pereiopod 4, ♀ (8); c, pereiopod 5, ♀ (9); d, basal segments of pereiopod 5, ♂ (9); e, basal segments of pereiopod 6, ♀ (9).

Epimeral plates with angular posteroventral corners (Fig. 1g), unarmed ventral margins and 1 to 3 setules on posterior margin.

Pleopod peduncle with 2 retinacula (Fig. 6c), shorter than rami. Pleopod 1: both rami 11-segmented. Pleopods 2 and 3 with 11-

segmented exopodite and 10-segmented endopodite. All setae of pleopod rami feathered, no clothes-peg spines.

Uropod 1 (Fig. 6a): Peduncle without proximoventral spine; 1 distomedial and 2 distolateral spines; 2 rows of 3 to 6 dorsal

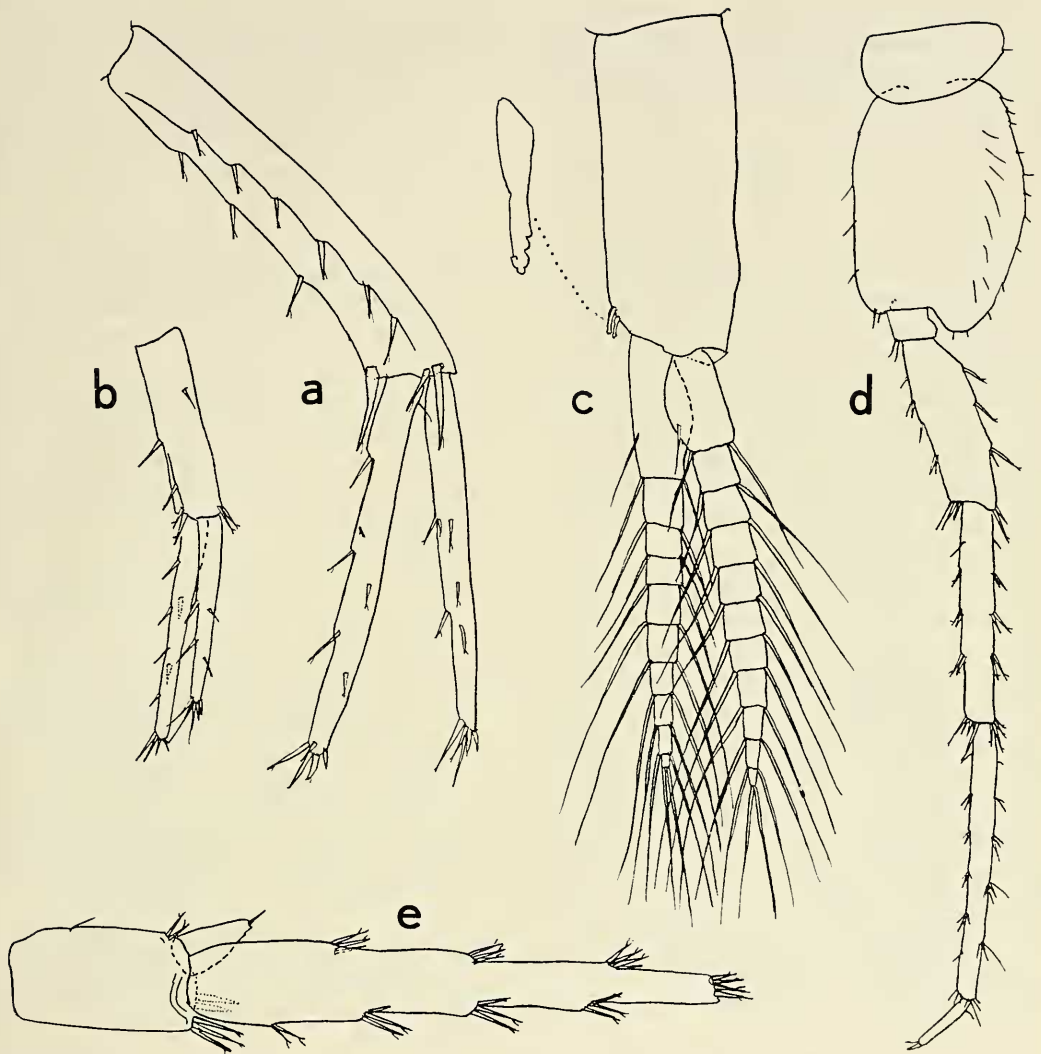


Fig. 6. *Eoniphargus glandulatus* ♀: a, uropod 1 (scale 8); b, uropod 2 (8); c, pleopod 2 (8); d, pereiopod 7 (9); e, uropod 3 (6).

spines. Exopodite slightly shorter than endopodite, both rami with dorsal, lateral and distal spines.

Uropod 2 (Fig. 6b) much shorter than U1, with proximal peduncular spine, but otherwise rather similar.

Uropod 3 (Fig. 6e) not sexually dimorphic, reaching far beyond tip of uropod 1 (Fig. 1a). Exopodite 1-segmented, terminal margin truncate with 4 spines; 4 groups of lateral spines and 3 groups of medial spines;

no setae. Endopodite scale-like, small, with 1 distal setule and a minute laterodistal notch.

Telson (Fig. 1e, f) deeply incised (over about 70% of its length); cleft V-shaped, rather wide. Armature variable: a lateral spine may be present or absent; distal armature of each telson lobe consisting of 2 or 3 spines and 1 setule; 2 long, plumose ("sensorial") setae distolaterally on each lobe.

Discussion.—The Korean taxon differs from *Indoniphargus indicus* (Chilton 1923) in the characters listed in Table 1 (see also Straškraba 1967 and Stephensen 1931). From the only species known of *Eoniphargus*, *E. kojimai* Uéno, 1955, it differs in (1) the monomerous accessory flagellum (4-segmented in *E. kojimai*); (2) the absence of calceoli on the male second antenna; (3) the shape of the exopodite of uropod 3 (with acuminate, unarmed distal end in *E. kojimai*; with truncate, spinose distal end in the new species); (4) the very strongly elongated antennal gland cone; (5) a slightly less elongate carpus of gnathopod 2; (6) the presence of spines on urosomites 1 and 2 (setules only in *E. kojimai*); (7) shorter aesthetascs on the flagellum of antenna 1.

Character states (1) and (2) are frustrating since they are often considered of some taxonomic value. However, the presence or absence of calceoli is a variable character in the genus *Gammarus* (e.g., *G. insensibilis* is permanently devoid of calceoli, cf. Stock 1967, whereas in *G. fossarum* certain populations lack calceoli, cf. Goedmakers 1972). Apparently, the new species is apomorphic in character states (1) and (2), in comparison with *Eoniphargus kojimai*.

Etymology.—The specific name is based on *glandula* (Latin = gland), alluding to the large size of the antennal gland.

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